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The Perfect Order Flow: Building Supply Chain Delivery Reliability

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A Project carried out on Operations Management course, with the supervision of:

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ABSTRACT

On-time delivery performance has become an imperative in serving digital consumers and a key dimension for assessing overall supply chain reliability within the context of e-fulfillment. As part of a four-month internship program at Nike's European Logistics Campus (ELC), in Laakdal, Belgium, the goal of this thesis is understanding the root causes behind Nike's failed delivery performance to consumer by mapping and reviewing the company's end-to-end digital order lifecycle. Following the analysis of a restricted sample of *Nike.com* orders for shipping destinations in BeNeLux and their aggregate performance through the end-to-end process, the primary sources of failure within Nike's order flow are identified and short-term recommendations are made for improving delivery performance to consumer.

Keywords: *Nike, Inc. European Logistics Campus, E-fulfillment, Delivery Reliability, Delivery Performance to Commit Date.*

ABBREVIATIONS

3PL - Third Party Logistics

DC - Distribution Center

DD - Delivery Document

DOMS - Digital Order Management System

DOT - Delivered-On-Time

EDD - Estimated Delivery Date

EDI - Electronic Data Interchange

ELC - European Logistics Campus

EMEA - Europe, Middle East, and Africa

KPI - Key Performance Indicator

PGI - Planned Goods Issue

PL - Packing List

PO - Purchase Order

ROT - Released-On-Time

SLA - Service-Level-Agreement

SO - Sales Order

SOT - Shipped-On-Time

TCP - Transportation, Customs, and Procurement

WMS - Warehouse Management System

1. INTRODUCTION

In line with the rapid growth of e-commerce, customers are currently demanding higher levels of online services, convenience and ever-faster on-time order deliveries. Delivery options, such as same-day or express (next-day) delivery, have become key success factors for e-commerce players and an increasing number of online vendors is nowadays striving to improve the digital shopping experience by reducing delivery times (McKinsey & Co., 2016).

Whenever a consumer places an online order, most e-retailers commit to a maximum delivery date to set customers' expectations and so does Nike, Inc. for digital orders received through its official site *Nike.com*. The order's so-called *Estimated Delivery Date* (EDD) is first communicated on the checkout page of the company's website and stands as Nike's delivery promise to the consumer (see Appendix A).

Delivery commitments have strategic implications in terms of company's credibility and overall customer satisfaction when shopping online. Nonetheless, Nike's ability of delivering to European-based consumers by the promised date depends on the reliability of its order fulfillment and distribution processes in place at Nike, Inc. European Logistics Campus (ELC) in Laakdal, Belgium. Spread across four locations in the Flemish countryside, this state-of-the-art centralized distribution center allows Nike to serve a multitude of omnichannel consumers, shipping on average 1 million units everyday across the EMEA region (Europe, Middle East, and Africa).

Given a 98% company's on-time delivery performance benchmark, as of now circa 96% of Nike's digital orders reach European consumers by the promised delivery date every month. Current performance has partially been achieved through the introduction of a buffer in the logic behind EDD calculation. In face of low order fulfillment and delivery reliability, the buffer serves indeed to offset the occurrence of late deliveries, which would otherwise translate into bad customer experience and churn

rate. However, complex systems' integration, lack of alignment within company's processes and incomplete performance measures hinder visibility and identification of the root causes behind such poor delivery performance to consumers.

As part of a four-months internship program within the Transportation, Customs, and Procurement Team (TCP) at Nike ELC and in close collaboration with all involved supply-chain stakeholders, this thesis will answer the following research questions:

1. *How reliable is Nike's supply chain in delivering to consumers?*
2. *Which are the root causes behind Nike's failed delivery performance to commit date?*

To answer the above questions, we will first review the importance of delivery performance for assessing supply chain reliability and introduce a metric suited to the scope of our research. Then, we will lead the reader through the stages and system architecture of Nike's end-to-end digital order flow, its internal key performance indicators (KPIs) and the logic behind the current EDD determination. To the purpose of our study, we will gather data for a restricted historical sample of *Nike.com* orders with shipping destinations in BeNeLux. Following data consolidation, we will analyze orders' performance through the end-to-end process, from order creation to last-mile delivery to consumer. The analysis will be aimed at measuring the reliability of Nike's e-fulfillment and distribution processes and identifying root causes and patterns for late deliveries and/or possible discrepancies of the currently-used EDD determination logic with the physical order flow. Finally, we will draw conclusions based on our findings and propose recommendations for Nike to improve order fulfillment reliability and delivery performance towards consumers.

2. LITERATURE REVIEW

A large share of academic literature agrees by far over the importance of *delivery performance* as an essential metric for assessing overall supply chain success. Lambert and Pohlen (2001) identify delivery performance as one of the key drivers of economic value added (EVA) within organizations, by retaining and strengthening the relationship with existing customers and driving up sales.

Delivery performance is also referred to by the *Supply Chain Operations Reference* (SCOR-) model as a sub-measure for supply chain reliability. Developed by the *Supply-Chain Council* (SCC) in 1996, the SCOR-model provides a standardized terminology for the description of supply chains and a framework for measuring the performance of supply chain activities (Sürie et al, 2015). Together with responsiveness and flexibility, delivery reliability is described as an external, customer-driven attribute of supply chains and broadly understood as the degree to which a supplier can consistently deliver 'the correct product, to the correct place, at the correct time, in the correct condition and packaging, in the correct quantity, with the correct documentation, to the correct consumer' (Coyle et al, 2012:153).

According to the proposed definition, it could be objected that *perfect order fulfillment* is a more exhaustive measure for supply chain reliability. However, within the context of this project, we will use *delivery performance to commit date* as a reliability metric for Nike's e-fulfillment and distribution model. Such decision is dictated by the purpose of benchmarking actual order delivery against Nike's *Estimated Delivery Date* (EDD). Thus, we define *delivery performance to commit date* as the percentage of orders that are fulfilled and delivered on or before the relevant promised date to consumers, i.e. Nike's EDD, and measured as follows:

$$\text{Calculation} = \frac{Total\ number\ of\ orders\ delivered\ before\ or\ on\ communicated\ EDD}{Total\ number\ of\ orders\ delivered}\ \%$$

3. NIKE'S END-TO-END DIGITAL ORDER FLOW

This section will first introduce and map Nike's end-to-end digital order lifecycle, the involved systems and the output of the different activities performed. In the second paragraph, we will review the internal metrics currently used by the company to measure performance throughout the process and how they relate to overall *delivery performance to commit date*. Last, the current logic behind EDD determination will be presented for orders shipped with a standard service option.

3.1 End-to-end Digital Order Lifecycle

Nike's end-to-end digital order lifecycle can be broken down into five major sub-processes, which we will refer to as (1) *Cart to Order*, (2) *Order to Release*, (3) *Release to Ship*, (4) *Ship to Deliver* and (5) *Returns*. Each phase further consists of a diverse set of activities which are enabled by the integration of several enterprise systems and in coordination with third-party logistics (3PL) providers.

Cart to Order refers to the activities performed by customers when submitting an order through *Nike.com.* After selecting the number of product units and size, the customer is transferred to the website checkout page where he is requested to fill in his shipping details and to select the payment method and delivery option desired. At this stage, the *Estimated Delivery Date* is shown to the consumer, calculated based on the shipping destination address. Simultaneously, a *Traty Code*, i.e. check-out service code, is assigned to the order according to the delivery service option selected. Once the order has been submitted, the information will be captured and transmitted to the pipeline for processing. Since the customer is in control of the process, *Cart to Order* is not considered within the scope of this project. Nonetheless, it is recognized the need for e-retailers to provide for a user-friendly platform and detailed information over products in a way to enhance service reliability of their website (Xifei et al, 2015).

Order to Release comprises all activities from order creation to release within the warehouse. Once the order has been submitted through the website, its associated payment method undergoes an automated fraud check. If found suspicious, manual fraud check is performed. Fraudulent orders are cancelled otherwise, the order is released from hold to soft inventory allocation within the *Digital Order Management System* (DOMS) and a confirmation e-mail is sent to the consumer, reinforcing the delivery promise. Next, a purchase order (PO) is created, formally authorizing for the payment transaction. Right after, DOMS determines the *Estimated Ship Date* of the order, also known as *Planned Goods Issue* (PGI) date, and transmits this information to a 3PL provider of software solutions which assigns the applicable *Carrier Service Code* for order shipment. The mentioned 3PL acts as a middleman in between Nike and the last-mile carrier, enabling EDI *(Electronic Data Interchange*) transmission of parcels' information as well as order delivery track & trace (T&T) functionalities. Then, the order is passed to SAP, which in turn creates a sales order (SO) and completes real time inventory check for the requested product items. Following, SAP generates a delivery document (DD) with all order information to facilitate the picking and packing activities within the warehouse. If a sales order includes items which are stored in different distribution centers (DCs), a delivery document is created for each shipping point. Nonetheless, a consolidation flag set by SAP may require ordered products originating from different shipping points to be joined together in a unique shipment later during the process at a separate consolidation facility. Lastly, the delivery document is released into the *Warehouse Management System* (WMS) within the corresponding distribution center. According to Nike-internal Service-Level-Agreement (SLA) standards, the duration of the entire *Order to Release* sub-process should take below 120 minutes.

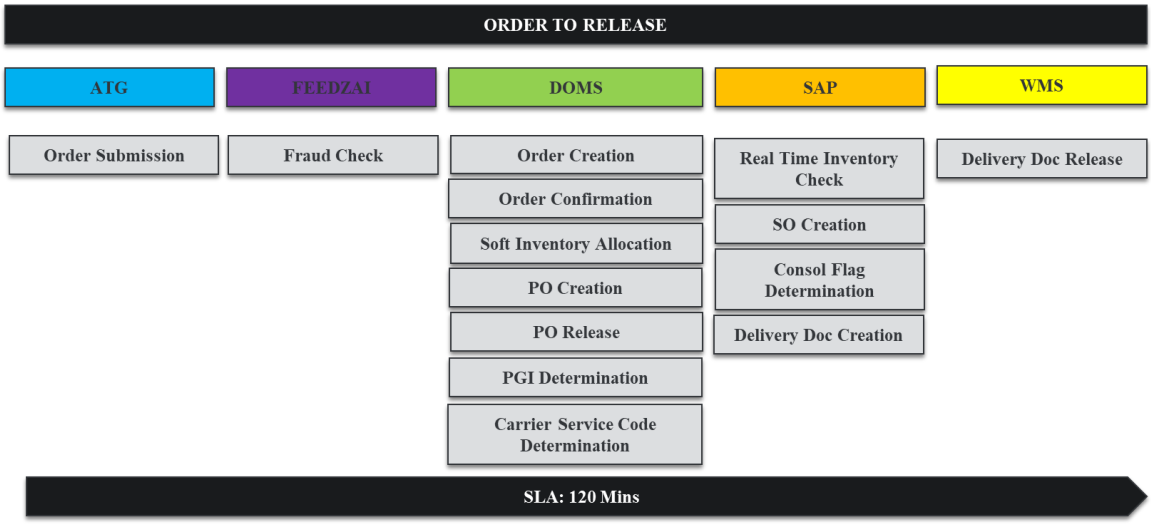


Figure 1. Digital Order Lifecycle - Order to Release

Release to Ship entails the picking and packing activities performed within the DC until the goods are handed over for shipment to the last-mile carrier. Once the order is received within the WMS, it is planned for processing according to the next possible cut-off and in line with SLA tables, which validate the previously-determined PGI date based on the delivery note release-time in the warehouse. General factors affecting the *Estimated Ship Date* are the minimum order processing lead time, the presence of a consolidation flag, the carrier's trailer pick-up days and the scheduled cut-off of trailer departure from Nike's premises. Once the order has been planned, a packing list (PL) and a Nike's carton number are created to enable picking and packing, which are finalized by the printing of the shipping label. Each carton receives three labels, specifically a Nike label, a shipping label reporting the carrier's *Carton Tracking ID* number and a return label placed within the box itself, in case the consumer wishes to return the purchased items. The shipping label is the most relevant one since, besides reporting the *Carrier Service Code* and other relevant parcel details, it includes the barcode used for recording order track & trace (T&T) events and allowing for EDI transmission. In case of consolidation orders, product items are first picked from their original DC and moved to the consolidation facility where picking and packing are

performed as already described. Once cartons are loaded into the corresponding trailer, the latter is sealed and picked up by the respective line hauler. In so doing, a sequence of events is triggered within WMS and SAP, including the EDI transmission of parcel information from Nike to the last-mile carrier. Similarly, the consumer receives an e-mail informing that the order has been dispatched and providing for the order's tracking number to T&T his parcel.

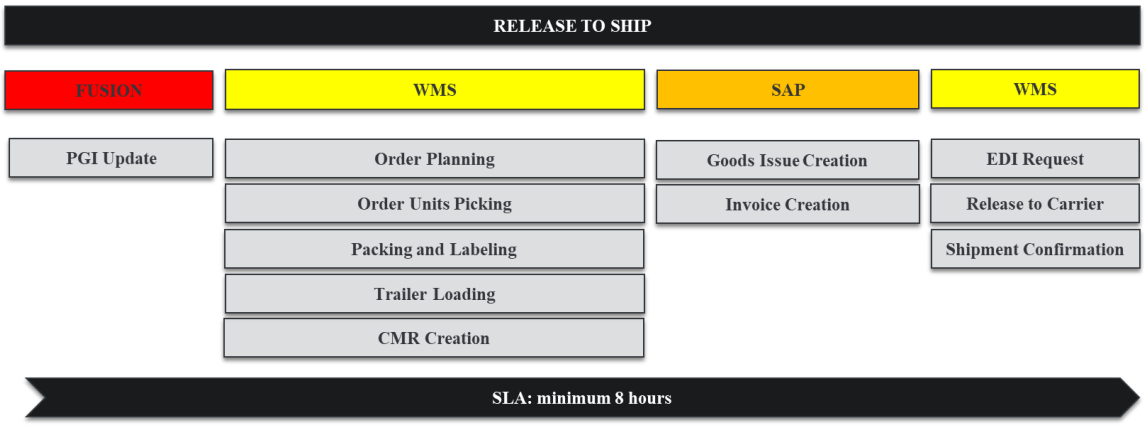


Figure 2. Digital Order Lifecycle - Release to Ship

Ship to Deliver is involved with the last-mile parcel delivery activities, which are outsourced to 3PL partners, i.e. last-mile carriers. After leaving Nike ELC's premises, the parcels are received at the carrier's first-injection hub and sorted based on their final delivery destination. Once processed, parcels are loaded onto internal linehauls routed to one of several local hubs within the carrier's network, before being delivered to consumers or dropped at a pick-up point of customer's choice. Any time a parcel is received or departs from a given location, the last-mile carrier sends an EDI message to Nike, which internally updates the delivery status of the parcel and enables consumers to track and trace their orders.

Returns refers to the process of reverse logistics, specifically the procedures and infrastructure in place allowing customers to return products if unsatisfied with their digital purchases. As a fairly-mature e-commerce vendor, Nike understands the importance of returns in creating long-term customer relationship, however, such sub-

process falls outside of the scope of delivery reliability and it needs to be dealt with separately.

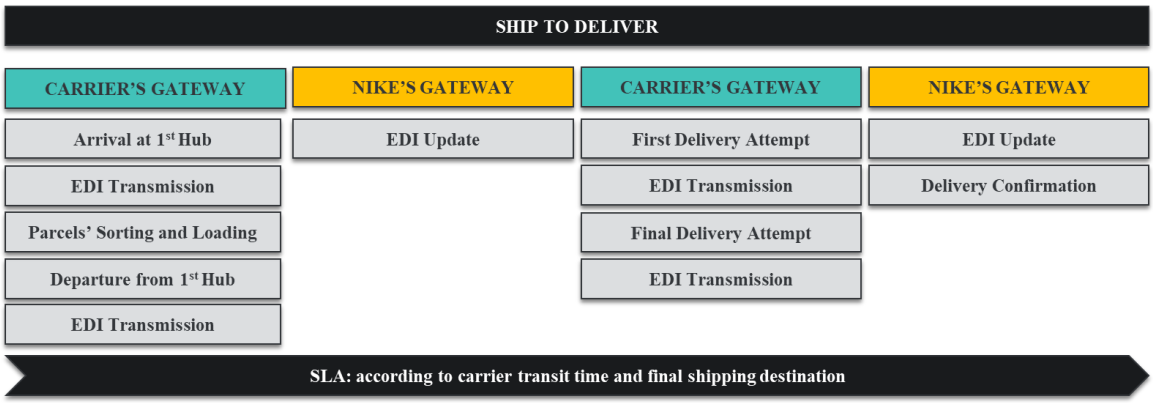


Figure 3. Digital Order Lifecycle - Ship to Deliver

3.2 Internal KPIs and End-to-End Performance Measure

At present, the performance of each of the three sub-processes in scope is measured by a corresponding KPI, which are respectively: (1) *Released-On-Time (ROT);* (2) *Shipped-On-Time (SOT)* and (3) *Delivered-On-Time (DOT).*

Released-On-Time (ROT) measures process performance from order creation to delivery document release in the warehouse and consists of two dimensions, reliability and speed, precisely. Reliability indicates whether a delay in the first activities/systems (fraud check, DOMS and/or SAP) impacted the order making it to the next possible warehouse planning cut-off hour, whereas speed measures whether the delivery document was released into the WMS in line with Nike's SLA standards (within 120 minutes from order creation). Although speed is considered important, the current target for Nike is 99% successful ROT reliability rate.

Shipped-On-Time (SOT) measures warehouse order fulfillment performance from the moment the delivery documents are received in the WMS for planning until the goods are released to the last-mile carrier. The KPI looks at the updated *Planned Goods Issue* (PGI) date, calculated following the order release in Fusion, and compares it to the *Actual Goods Issue* date. If the latter is posterior to Fusion's *Estimated Ship*

Date, the order shipped late and therefore it failed SOT performance. As of now, Nike's SOT benchmark is 98% on-time shipments, measured in number of shipping units.

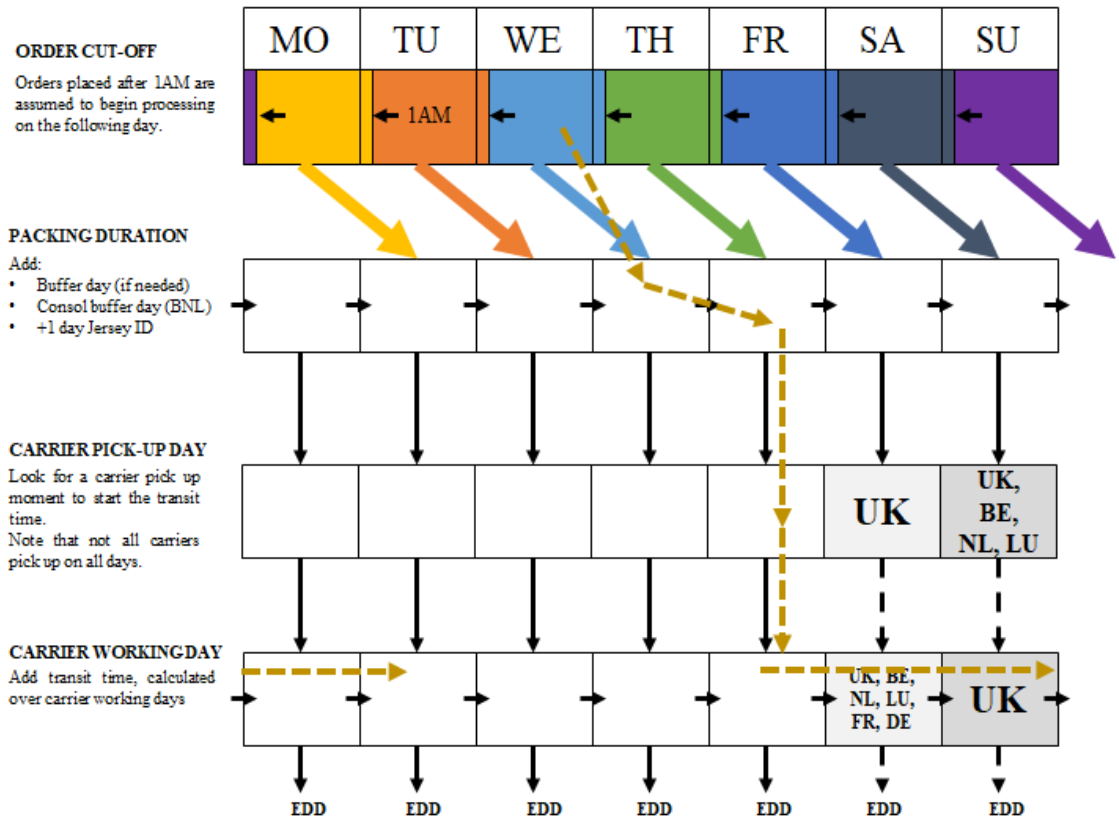
Delivered-On-Time (DOT) measures delivery performance of the last-mile carrier. Based on the trailer departure date from Nike ELC's premises, the expected date of delivery of the packing list (or carton), also known as *Expected Delivery Date*, is calculated adding contractually-agreed transit days. The KPI eventually compares this expected date to the *Final Delivery Date* to consumer and in case of late delivery, it further accounts for the party responsible for the delay, i.e. Nike, last-mile carrier or the customer, based on the EDI exception scans received by the parcel. Reported on a packing list level, Nike's is currently targeting 98% positive DOT performance.

The aforementioned KPIs are metrics of internal logistics processes and do not measure overall supply chain performance. In brief, they fail to provide insights on how effectively the entire supply chain has met the delivery promise to consumer (Lambert et al, 2001). The latter is captured by *delivery performance to commit date,* also known as *EDD performance*, understood as a measure to integrate performance across different stages of the order lifecycle. Such metric compares the initial *Estimated Delivery Date* communicated at check-out to the date of the *First Delivery Attempt* received by the order and assesses whether the delivery promise to consumer was kept.

3.3 Estimated Delivery Date (EDD) Determination

As mentioned in previous paragraphs, the *Estimated Delivery Date* (EDD) indicates the date when the order should be delivered to the consumer and expresses Nike's delivery commitment. For every shipping destination and delivery service option supported on *Nike.com* check-out page, an associated EDD can be determined once shipping details have been inserted by the consumer. Such determination relies however on a set of standardized assumptions summarized in Figure 4.

Let's consider an order placed on a Wednesday at 7 pm with a shipping destination in Milan. According to the logic illustrated, the order is assumed to begin processing on Thursday since the 1 am cut-off has already passed. Adding a buffer day for pick & pack duration, the order will be ready for shipping on Friday only. Provided that the last-mile carrier for Italy delivers during weekdays only (Mon-Fri) and adding 2 days of carrier transit time, the consumer will be shown a final EDD of Tuesday when submitting the order. In case any delay occurs in the order processing and fulfillment, the *Estimated Delivery Date* will not be recalculated.



Country	Packing Duration	Carrier Pick-up Days	Carrier Delivery Days
UK	Buffer day	Mo-Su	Mo-Su
BeNeLux	Consolidation Buffer day	Su-Fr	Mo-Sa
FR & DE	Buffer day	Mo-Fr	Mo-Sa
All else	Buffer day	Mo-Fr	Mo-Fr

Key City	Carrier Transit Time
London	1
Paris	1
Berlin	1
Barcelona	2
Milan	2

Figure 4. Estimated Delivery Date Determination - Standard Service Option

The assumptions behind the current EDD calculation are knowingly too rigid and not in line with the physical order flow, specifically with regard to the order processing cut-off time and pick & pack lead time. Moreover, *Consol Determination* at check-out is roughly performed based on whether the order consists of different product engines, i.e. product types. As of now, Nike's website interface (ATG) distinguishes among three product engines, respectively *apparel, footwear* and *equipment* and it assumes each product type to be stored in a separate and unique DC. In truth, items belonging to the same engine can originate from different warehouses and therefore require for consolidation, which will be determined only within SAP at a later stage of the lifecycle. For a complete overview of DCs and corresponding product engines in stock, refer to Appendix B.

4. METHODOLOGY AND DATA ANALYSIS

To answer our initial research questions, we collected an historical sample of *Nike.com* orders created between August 1, 2018 and August 31, 2018, and delivered with a standard service option to shipping destinations in Belgium, Netherlands or Luxembourg (BeNeLux). The choice of such geographic market has been dictated by the fair simplicity of the order fulfillment and distribution set-up in place, given the proximity of Nike's ELC to the region. The three countries in scope are indeed served by the same last-mile carrier, which picks up trailers from Nike's premises from Sunday to Friday and performs deliveries to consumers six days a week (Mon-Sat). According to Nike's SLA, the internal warehouse planning cut-off hour for same-day processing and shipping is at noon and trailer departure is scheduled at 8 pm. The carrier's expected transit time until final delivery to consumer is one working day. For a visual overview of the standard cut-off times and the current distribution set-up for the BeNeLux region, refer to Appendix C.

The data was retrieved from the enterprise systems already mentioned, such as DOMS, SAP and WMS, and consolidated on carton-level. Covering the end-to-end order flow, the dataset included relevant timestamps for each sub-process and order information, including the initial EDD communicated to consumer at checkout. The dataset was further filtered for unique *Carton Tracking ID* numbers, in the effort of excluding duplicate observations. Orders missing information concerning first/final delivery attempt and/or trailer departure date have been filtered out. Overall, the dataset was composed of $n = 57{,}857$ observations.

A main assumption in our analysis was that each carrier's *Carton Tracking ID* corresponded to a unique digital order. In practice, however, orders consisting in a large number of units are split and shipped in more than one physical carton. Such assumption was needed in view of the difficulty in tracing a unique order identifier through the end-to-end lifecycle, since enterprise systems have different visibility on order IDs and document numbers. In a similar way, the internal process KPIs were measured on a carton-level.

To determine the sources of delay and failure within Nike's digital order flow, we measured orders' aggregate performance throughout the different stages of the end-to-end process. By measuring single activities' lead times and though the identification of weekly trends and relevant order characteristics, the main root causes for late fulfillment and delivery were revealed.

5. FINDINGS AND DISCUSSION

Overall Dataset Performance

In the first stages of our analysis, we measured the overall performance of the dataset through the end-to-end digital order lifecycle to assess how many orders followed a perfect order flow and successfully met the *Estimated Delivery Date* communicated to consumers.

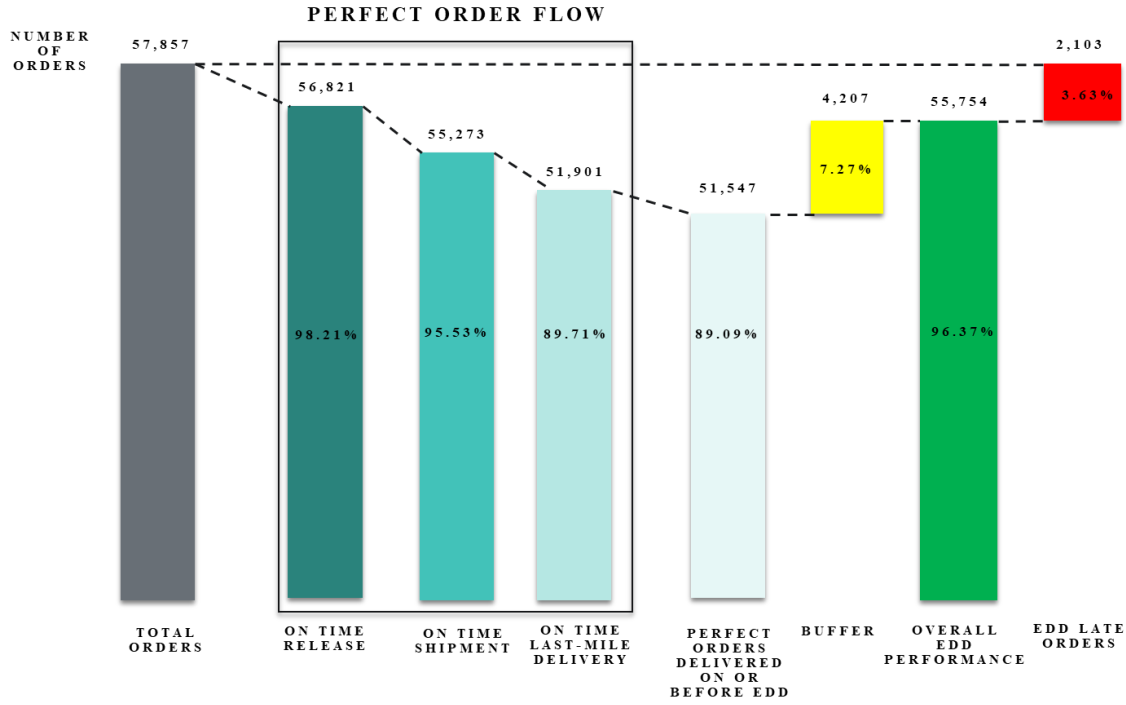


Figure 5. Perfect Order Flow - Overall Performance

Overall, 89.09% of total orders were found to follow a perfect order flow, scoring on-time performance through all three sub-processes and reaching the consumer by the promised date. Nonetheless, *delivery performance to commit date*, i.e. *EDD performance*, was reportedly 96.37%; 7.27 percentage points higher than the perfect order rate. This difference was explained by the presence of a buffer when determining EDD, which accommodates for possible delays in the end-to-end process, leading to improved delivery performance to consumer. In fact, whenever an order fails performance through any of the internal sub-processes, the latter should ultimately miss the EDD. However, this seemed not to be the case for a significant number of

observations which, despite missing internal cut-offs due to delays and/or process failures, still reached the consumers on the promised date.

The buffer's presence also explained for 59.73% of orders being delivered before the communicated date, with an average of 1.4 days earlier delivery to final consumer (see Appendix D). Conclusively, the primary source of buffer was identified in the misalignment between the online order processing cut-off hour assumed at the time of EDD determination with the actual warehouse planning cut-off. In truth, a large amount of orders submitted after 1 am still managed to be released into the DC before noon and therefore be planned for picking, packing and shipping over the same day. On the other hand, the EDD logic assumed these orders to start processing only on the day following their creation.

Despite a short investigation over the buffer's nature, our research focused on late orders, which represented 3.63% of the dataset. Studying the sample available, the effort lied in understanding the primary causes behind late delivery performance by reviewing the end-to-end order flow.

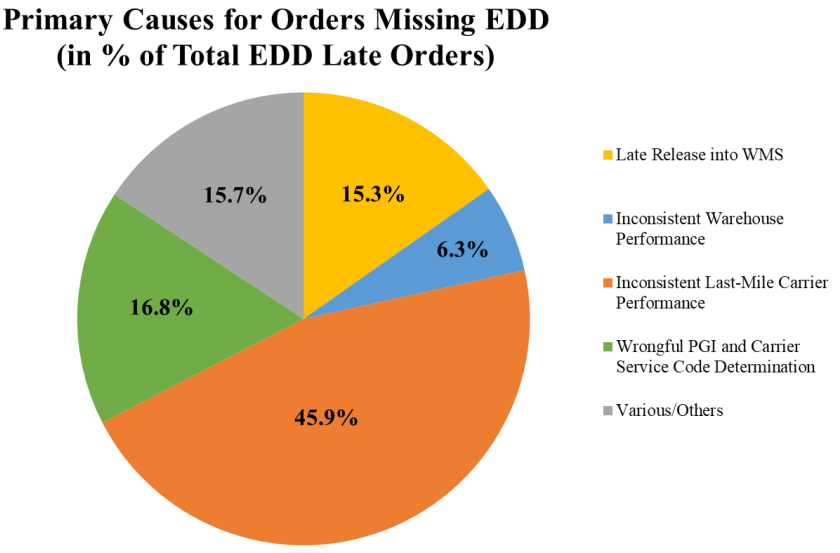


Figure 6. EDD Late Orders - Primary Causes for Orders Missing EDD

Manual Fraud Check and Purchase Order Release

On average, the duration of the *Order to Release* sub-process was found to be 137.7 minutes, with a standard deviation as high as 759 minutes. Being the average lead time not compliant with SLA standards, a small number of severely-late observations justified for the large level of variation, with a maximum registered ROT duration of 69,056 minutes, equivalent to 47 days circa. Although it can be argued that some of these orders should be disregarded from the analysis as being outliers, ROT speed performance was reportedly unsatisfactory and drawing near 90.8%.

The main reasons for such poor performance were identified in manual fraud check and PO release time to SAP. Indeed, the average lead time needed to perform manual fraud check was recorded to be 657.5 minutes, nearly 11 hours, causing 77% of orders undergoing this stage to miss the next possible warehouse planning cut-off. Similarly, for orders failing ROT speed performance the average time observed between PO creation and release was 147 minutes, with a maximum time to release of 1,234 minutes. Due mainly to systems' outages and interruptions, such delays in the *Order to Release* sub-process accounted for 15.3% of total late deliveries to consumer.

Inconsistent Warehouse Performance

In spite of being the unique root cause of failed delivery performance for only 6.3% of total EDD late orders, inconsistent SOT performance was found to be warehouse-specific, with one DC alone causing almost 67% of total shipped-late orders in the month of August. The latter being said, given the dataset available it was not possible to establish unequivocal reasons behind low warehouse performance. Yet systems' outages and maintenance, capacity constraints as well as program releases are believed to have an impact.

Inconsistent Last-mile Carrier Performance

In view of the perceived results, inconsistent last-mile carrier performance represents the biggest source of failure within Nike's digital order flow for BeNeLux. In fact, 47.8% of total EDD late orders were found to miss the promised delivery date to consumer due to negative DOT performance, with an average carrier transit time of 2.3 days for late orders.

Despite selecting 3PL partners based on the level of service and convenience offered to consumers and the reliability of their network in the region, Nike has limited control over the last-mile delivery activities, being the *Ship to Deliver* sub-process fully outsourced. Still, from a consumer's perspective Nike is responsible for order delivery and therefore it should implement suited strategies to cope with such failure in the process.

Estimated Ship Date and Carrier Service Code Determination

Despite following a perfect order flow, 0.61% of total orders were found to miss the promised date to consumer for no reason directly associated to delays in the end-to-end process. These represented 17.5% of total EDD late orders.

Interestingly, 75.1% of impacted orders had a promised delivery date on Saturday and an equivalent *Traty Code* (SAT). Even though these parcels timely shipped from Nike ELC on Friday, 86% of such received a first delivery attempt the following Monday only, causing the orders to ultimately miss the EDD. This anomaly was proven to repeat over the weeks throughout the month of August in scope.

Despite assigning a precise *Traty Code* for estimated deliveries on Saturdays, the consumer does not have the possibility to choose this weekday as a separate delivery option on *Nike.com* check-out page, therefore Saturday deliveries are considered as a standard service option from Nike's perspective. The latter being said, 89.4% of the interested SAT orders were later assigned with a standard (weekday) *Carrier Service*

Code (DPDM) and an applicable shipping label, following determination of the *Estimated Ship Date* in DOMS. For this reason, despite being received at the last-mile carrier's injection hub on Friday, the parcels were left on hold for the weekend. In fact, even though Saturday deliveries are supported in BeNeLux, in agreement with Nike, the 3PL partner is entitled to prioritize those cartons received at the hub on Friday, which feature a Saturday service shipping label. On the other hand, delivery of standard service parcels is postponed to the following Monday, with no impact in terms of last-mile carrier performance (DOT).

Conclusively, the *Traty Code* assigned at the check-out was found to be irrelevant in determining the *Carrier Service Code*. The latter is assigned to an order based exclusively on the estimated weekday of shipment communicated by DOMS and therefore, Saturday carrier code (DPDZ) is assigned uniquely to orders whose *Estimated Ship Date* falls on Fridays.

Once the nature of the problem was understood, the root causes of such were identified within the PGI determination logic applied in DOMS, which triggers carrier code determination (see Appendix F). As of now, Nike order's *Estimated Ship Date* is calculated looking at current time of determination and it fails to account for the remaining duration of the *Order to Release* sub-process. Therefore, whenever the PGI date for an order is estimated close to the warehouse planning cut-off time, chances are high that the order will be released into the DC after the relevant cut-off and therefore, it will be planned for processing and shipping over the following day only. In this case, the updated PGI date validated after warehouse release in Fusion will not match with DOMS' initial PGI. However, *Carrier Service Code* will not be re-determined at this stage.

Such failure in logic becomes relevant for orders created on Thursday morning after the 1am online cut-off, and which received an EDD on Saturday. For these orders,

DOMS' *Estimated Ship Date* is determined to be on the same day of order creation. Consequently, the orders are assigned with a standard *Carrier Service Code* (DPDM) as they are expected for delivery on Friday, one day earlier than the promised delivery date due to the buffer's presence. However, in case the orders are released into the WMS after the warehouse planning cut-off time of noon, the updated PGI date and *Actual Ship Date* will shift to Friday, but *Carrier Service Code* will not change to Saturday service level (see Appendix G). Despite leaving Nike's premises on Friday, these parcels will be delivered on Monday only since they have received a standard *Carrier Service Code* and an equivalent shipping label.

A second failure within the PGI determination logic is represented by the order consolidation assumption. Since neither *Nike.com* website interface (ATG) nor DOMS have source-awareness on physical stock (visibility over shipping point per product), consolidation is assumed exclusively in case different product engines are included in the same order. Therefore, whenever the ordered items belong to the same engine but originate from different DCs (see shipping points combinations 1060-1067 for Apparel or 1064-1065 for Footwear products), *Estimated Delivery Date* and *Estimated Ship Date* will be underestimated and not account for the extra processing time needed to join the units in a unique shipment. As already mentioned in previous paragraphs, physical consolidation is established only within SAP at a later stage in the process and considered when performing PGI validation at warehouse.

6. CONCLUSIONS

As of current state and in view of the performance figures attained, the buffer included in Nike's *Estimated Delivery Date* determination logic needs to be maintained to accommodate for the discussed sources of failures in the end-to-end digital order flow. The buffer also becomes a necessity in peak business periods such as Black Week

or Holiday Season, where due to increase in online sales, high volume needs to be processed and shipped and delivery reliability to consumer becomes a key success factor.

On-going projects are attempting to reduce order-release lead time to warehouse within seconds from order creation with the goal of supporting speed to the final consumer. Although challenging, the strategy relies on performing essential and secondary activities in parallel instead of sequentially. In so doing, Nike aims at streamlining the *Order to Release* sub-process and flowing orders directly from website to the DCs.

Despite the progressive introduction of lean management techniques in order planning and warehouse processing as well as performance-based penalties and incentives schemes towards 3PL partners, in the short-term reviewing the determination of *Estimated Ship Date* performed in DOMS, which ultimately triggers carrier code determination, could lead to improved delivery performance to consumer.

Optimally, the *Carrier Service Code* should be assigned to orders based on their *Actual Ship Date*, when the shipping label is requested for printing. However, considering the level of investment required for changing the existing process and systems' set-up, improving the PGI determination in DOMS by revisiting its underlying assumptions appears to be the most feasible solution for Nike.

In first place, when determining PGI date, DOMS should account for the estimated remaining duration of the *Order to Release* sub-process. Moreover, provided that DOMS receives daily snapshots of physical inventory from SAP, including information over plant code and product engine for each item in stock, a more truthful consolidation assumption could be built upon unique combinations of plant codes and product engines. In so doing, orders consisting of units belonging so the same product type yet

stored in different DCs could be flagged as *Consol* before being released to SAP and PGI date would account for the extra processing time needed for consolidation.

In conclusion, the proposed adjustments would improve accuracy of DOMS' *Estimated Ship Date* and consequently, *Carrier Service Code* determination so that orders undergoing a perfect flow would be proven to meet the promised delivery date to consumer.

7. LIMITATIONS AND FURTHER RESEARCH

The choice of *delivery performance to commit date,* defined as the ratio of orders delivered on or before EDD to the total number of orders delivered, as a measure for supply chain reliability imposed a major constraint to this research. The proposed metric indeed fails to capture the size of orders not delivered. At present, these orders represent a "black hole" in Nike's performance measures and a suited metric should be implemented to assess their impact on supply chain performance.

A further limitation was represented by the low reliability and inaccuracy of Nike's systems. Despite being able to retrieve a large sample size, presence of outliers remained a constant issue throughout the research. The latter being said, the analysis provided sufficiently robust insights on the main sources of delay and failure within Nike's e-fulfillment process.

Although the main sources of failure in the end-to-end physical flow are believed to be transverse to all geographic markets served by Nike ELC, different issues concerning the order processing model and set-up in place could be disclosed by performing a similar exercise for other countries or delivery service options in portfolio.

Eventually, a starting point for further research would be assessing the potential business impact of improved delivery performance to consumer, resulting from the application of the proposed recommendations.

8. REFERENCES

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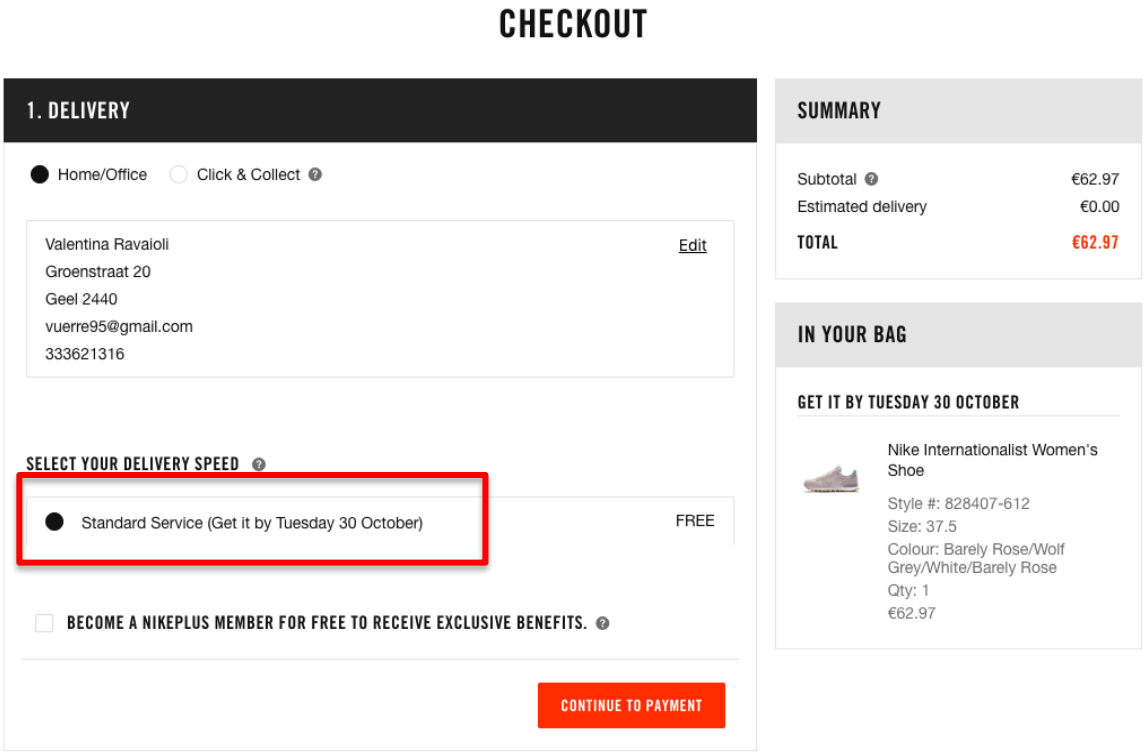
APPENDICES

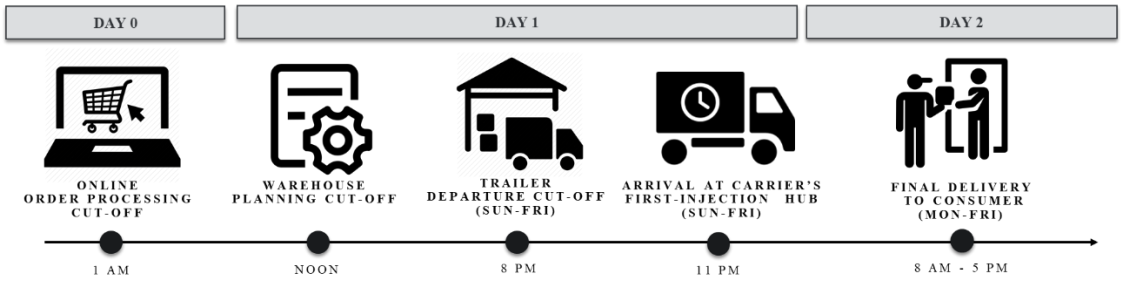
Appendix A - Delivery Promise at Checkout Page



Appendix B - Distribution Centers (DCs) and Product Engines in Stock

DC Name	Shipping Point Code	Plant Code	Product Engine in Stock
APPAREL 1	1060	1060	Apparel
WINGS	1064	1064	Footwear
FOOTWEAR 1/2	1065	1065	Footwear
APPAREL 3	1067	1067	Apparel
HERENTALS	1164	1064	Equipment
COURT	1264	1064	Apparel
GOLF/HURLEY/XPO	1068	1068	Mix

Appendix C - Order Cut-off Times and Distribution Set-Up – BeNeLux Region



Appendix D - Overall Delivery Performance

Delivery Performance Status	Nbr. of Orders	% of Total Orders
Early	34,557	59.7%
Late	2,103	3.6%
On Time	21,197	36.6%
Grand Total	**57,857**	**100.00%**
	Overall EDD Performance	**96.4%**

Early Orders	
Descriptive Statistics	Days Early
Minimum	1
Maximum	6
Mean	1.39
St. Deviation	0.63
Mode	1

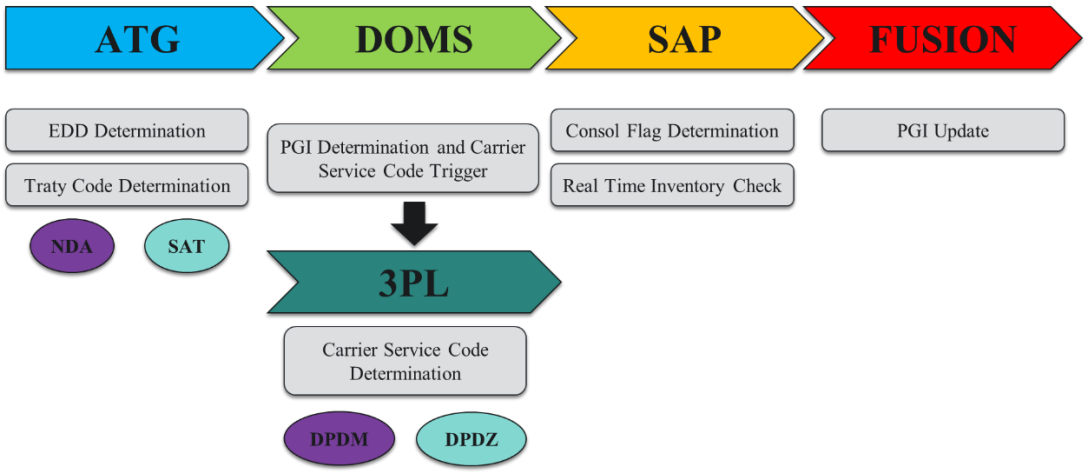
Late Orders	
Descriptive Statistics	Days Late
Minimum	1
Maximum	77
Mean	2.44
St. Deviation	2.96
Mode	2

Appendix E - Internal KPIs Performance

	ROT Speed		ROT Reliability		SOT		DOT	
Status	#Orders	%	#Orders	%	#Orders	%	#Orders	%
On Time	52,537	**90.8%**	56,821	**98.2%**	56,293	**97.3%**	53,440	**92.4%**
Late	5,320	9.2%	1,036	1.8%	1,564	2.7%	4,417	7.6%
Benchmark	-	-	-	99.0%	-	98.0%	-	97.0%
Gran Total	57,857	100.00%	57,857	100.00%	57,857	100.00%	57,857	100.00%

		ROT Speed Performance	
ROT Duration (in mins)	Total Orders	On Time	Late
Minimum	21.1	21.1	120
Maximum	69,056.2	119.98	69,056.2
Mean	137.7	61.3	892.5
St. Deviation	759.3	18.2	2,375
SLA	**120**	**120**	**120**

Appendix F - PGI and Carrier Code Determination



Appendix G - Perfect Orders Missing the Estimated Delivery Date to Consumer